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ABSTRACT

An evaluation of a summer geography institute focusing on the use of thematic maps as tools for teaching across the curriculum was conducted during 1988. The annual institute is sponsored by the Tennessee Geographic Alliance in conjunction with the National Geographic Society. Thematic map making involves portrayal of visible patterns of inequality that stimulate questions and responses. In essence, thematic maps are tools for eliciting speculations, tentative explanations, and hypotheses to be tested. The 1988 institute involved 24 fourth- through 12th-grade teachers from Tennessee and South Carolina. Five techniques were used in the comprehensive evaluation of the institute: (1) participant observation; (2) participant perception survey; (3) participant interviews; (4) content analysis of participant diaries; and (5) content analysis of institute materials. A total of 36 activities and 30 materials were coded and charted by investigators to determine levels of learning style accommodation and thinking skills facilitation. Results indicate that thematic mapping accommodates a range of perceptual learning styles and contributes to the development of higher order thinking skills and processes. In addition, simple analyses of instructional activities and materials can generate valuable information for instructional decision making. (TJH)

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A STUDY OF LEARNING STYLE ACCOMMODATION AND THINKING SKILLS INSTRUCTION FOUND IN THE TEACHING OF THEMATIC MAP USE

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by Russell L. French, Theodore H. Schmudde and Gordon C. Bobbett*

BACKGROUND

For Several years, the Tennessee Geographic Alliance in conjunction with the National Geographic Society has sponsored a series of summer geography institutes for teachers. The 1988 Geography Institute focused on the use of thematic maps as tools for teaching across the curriculum. Thematic map making requires the portrayal of categories of values as spatial distributions on maps. These thematic portrayals result in visible patterns of inequality which stimulate questions and responses. In essence, thematic maps are tools for eliciting speculations, tentative explanations and hypotheses to be tested.

The 1988 summer institute was targeted to teachers in grades 4 through 12. Twenty-four teachers from Tennessee (22) and South Carolina (2) participated in the program which was developed around four objectives:

1. to provide participants with instruction and an instructional manual on the preparation of thematic maps from readily available information sets;

2. to engage participants in the use of thematic maps to explain mapped patterns, to speculate about associated patterns and to test the explanations and speculations against appropriate evidence;

3. to demonstrate the pedagogic value of thematic maps for teaching and learning basic place location, for assessing and exploring a vast array of information about the world, and for involving students in speculative and analytical thinking;

4. to test and improve the instructional manual as an instrument for multiplying the dissemination of instruction on thematic maps as teaching tools.

Institute developers (Drs. Theodore Schmudde and Sidney Jumper, Department of Geography, University of Tennessee at Knoxville) requested that two evaluators

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(Dr. Russell French, University of Tennessee at Knoxville and Dr. Gordon Bobbett, Union College) design and implement a comprehensive evaluation of the institute. After reviewing the objectives of the program and its planned activities, the evaluators proposed that the evaluation design include analyses of the learning styles accommodated and the thinking skills and processes utilized in institute content and processes. This proposal was made because two of the areas of current, great concern in K-12 instruction are the development of thinking skills and accommodation of learner differences--particularly differences in individual learning styles. When the evaluators were presented Institute agendas and descriptions of activities to be employed, it was immediately apparent that Institute staff would be teaching participant teachers much more than the use of thematic maps across the curriculum.

It was hypothesized that teachers who used what they had experienced and learned in the Institute in their own classrooms would a) address a range of perceptual learning styles during instruction and b) facilitate the development and use of a number of thinking skills and processes. If, indeed, it could be demonstrated that Institute content and activities did address a range of thinking skills and learning styles, the pedagogical value of thematic map making and utilization would be enhanced, and Institute participants (teachers) could be shown how they might practically accommodate learner differences and integrate thinking skills instruction more fully into the daily curriculum.

Based on these propositions, Institute staff readily agreed that evaluators should conduct the proposed analyses. Frameworks and procedures for the analyses were left to the discretion of the evaluators.

RESEARCH DESIGN

Five techniques were used in the comprehensive evaluation of the Institute: presence of a participant observer, survey of participant perceptions, partici-

pant interviews, content analysis of participant diaries and content analysis of Institute materials (manual, handouts, etc.). Only the first and last techniques focused on learning style accommodation and thinking skills utilization.

Participant Observer

The participant observer attended the entire two-week Institute, observing each activity and interaction. He wrote detailed descriptions of the activities, recorded information provided by staff and collected copies of all materials for later analysis. His observations were important to three facets of program evaluation: 1) analysis of institute dynamics, 2) formative evaluation feedback to staff each day which served as a basis for daily adjustments in schedule and activities, and 3) identification of thinking skills and learning styles addressed through instructional activities and methods and through instructor-student interactions.

After the Institute was completed, the participant observer's notes and activity descriptions, as well as the materials he had collected were submitted to content analysis. Imbedded thinking skills and processes and perceptual learning style accommodations were coded and charted using selected classification frameworks.

Analysis of Learning Style Accomodations

Assessment of learner styles is a relatively new field of pedagogical research. Therefore, there are numerous models and frameworks available, not all of them in agreement with each other. However, a survey of the research available indicates that most learning style researchers agree that a key aspect of overall learning style[1] is the individual's perceptual style--his/her dominant use of one or more of the five senses to stimulate inquiry and gather information. Further, it is clear that perceptual style is the aspect of overall style which is easiest for a classroom teacher to identify in the context of

group instruction because so much can be seen in the learner's choice of activities and approach to learning the defined content. Perceptual style differences are also easiest for the teacher to accommodate because much can be done through the use of available media, selection of materials, grouping of learners, and selection of activities.

The evaluators chose to focus attention on perceptual styles accommodated in institute activities and materials using the framework developed by French[2] and researched by Gilley[3], Cherry[4], Schaiper[5] and others. In this framework, seven different perceptual learning styles have been identified:

Print-Oriented	- Dependency on reading and writing activities.
Aural	- A listener; doesn't say much.
Interactive	- A talker; verbalization triggers thought. (not necessarily a good listener)
Visual	- Dependency on visual representations such as pictures, graphs, cartoons, moving images.
Haptic	- Grasp and feel are important; has to get his/her hands into it.
Motor (Kinesthetic)	- Movement triggers thought and is essential to learning most content.
Olfactory	- Individual approaches learning first through smell and/or taste.

The seven perceptual styles outlined have been proven to exist among both youth and adults. In some individuals, one of the seven perceptual modes is dominant; in others, two or three modes are equally strong (dominant).

Examination of the seven perceptual styles yields logical notions about how one might accommodate the range of styles existing in a group of learners through use of various media, materials and activities. It was not the intent of the external evaluators of the Institute to assess what could have or should have been done to address the learning styles of the participant

learners, but, rather, to identify what styles actually were accommodated by the instructors in using the activities, media and materials which they did. Since they were supposedly modeling what could be done with elementary and secondary students, it was assumed that the teachers attending the institute would transfer many of these activities, materials and teaching strategies to their own classrooms. If the teachers could be shown what styles actually were addressed when one or another of the institute's components was used, they had a new tool for making classroom instructional decisions and for justifying to administrators, parents and others their selection of particular content and instructional activities. If institute staff could be made aware of what learning styles were not addressed instructionally during the Institute, they could expand the range of activities and materials used in subsequent institutes.

Analysis of Thinking Skills Utilization

The inability of American students to think critically and creatively has received a great deal of media attention in the last few years, and numerous, recent books, journal articles and professional development programs for teachers have attempted to define thinking skills and to offer instructional strategies for improving them. As might be expected, the concern for improvement of thinking has generated a number of conceptual frameworks for classifying thinking skills and processes. A key decision for the evaluator team was selection of a framework for identifying and coding the levels and types of higher order thinking modeled in Institute activities and materials. As in the case of learning style accommodation, the classification system for thinking skills and processes needed to be one which participant teachers could easily understand and transfer to their own instructional planning.

Ultimately, the evaluators choose to classify Institute materials and activities in accordance with portions of a three-tiered conceptual framework offered by Barry Beyer[6]. This conceptual model of thinking divides human cognition into three levels:

LEVEL III: Micro-Thinking Skills

Eight skills adapted from Bloom's Taxonomy of Cognitive Objectives. In Beyer's hierarchy, the micro-thinking skills are the building blocks upon which Level II skills and Level I strategies are constructed.

LEVEL II: Critical Thinking Skills

Ten processes used by human beings to analyze and assess the worth and validity of events and ideas. These ten processes utilize combinations of micro-thinking skills.

LEVEL I: Thinking Strategies

Three broad cognitive strategies employing micro-thinking and critical thinking skills in various combinations. The three strategies as defined by Beyer are Conceptualizing, Decision-Making and Problem-Solving.

Evaluators selected the Beyer framework as the basis for identifying thinking skills and processes modeled in the Institute because 1) it offers a relatively simple and logical yet comprehensive means of thinking about thinking and 2) most teachers have received some training in the use of the Level III (micro-thinking) skills in preparing lesson objectives and classroom questions. However, the evaluator team chose to code Institute activities according to Levels I and III of the framework only, so that the amount of information available to participant teachers would not be overwhelming and would have a greater likelihood of being transported to peers in professional development/inservice workshops and to students in classroom instruction. Readers of this report will find in the appendix each Institute instructional activity and all instructional materials coded for their contributions to the development of micro-thinking skills and thinking strategies as defined below:

LEVEL III: MICRO-THINKING SKILLS

Low Cognitive

Recall	- remembrance of specific lists of information (terminology, facts)
Translation	- putting ideas into other forms
Interpretation	- reordering ideas into new configurations or meanings
Extrapolation	- predicting/inferring on the basis of given data
Application	- applying appropriate abstractions to situations, events
Analysis	- breaking down material into its components and detecting the relationships among parts
Synthesis	- putting elements/parts together to form a new whole or pattern

High Cognitive

Evaluation	- making judgments using given or invented criteria

LEVEL I: THINKING STRATEGIES

Conceptualizing	- generalizing from specifics to invent concepts or models
Decision-Making	- making, analyzing and evaluating choices
Problem-Solving	- identifying, clarifying and solving a problem

FINDINGS

Thirty-six (36) activities and thirty (30) pieces of material from the Institute were coded and charted by the investigators. Activities consisted of presentations by staff members accompanied by staff-participant discussions, group activities and demonstrations. Materials used in the Institute included various types of maps presented on paper or transparency, expository materials and reprints of articles. Although the materials were used within the context of presentations or group activities, investigators analyzed them as "free-

standing". The thinking skills/strategies and learning styles required to process the material were considered apart from whatever use(s) an instructor might make of them. Following are key findings in each area--learning style accommodation and thinking skills facilitation.

Learning Style Accommodation

As the charts contained in the appendix show, six of the seven perceptual learning styles identified by French, et. al. were addressed during the Institute through activities and materials. Only the olfactory style was omitted.

The most addressed learning style was print orientation which received attention on 52 occasions (22 activities, 30 pieces of material). Indeed, 100 percent all materials and 61 percent of all activities introduced into the Institute required some use of the print medium.

The second most used learning style in the Institute was the visual. Something for the visual learner occurred 45 times (25 activities, 20 pieces of material). Approximately 70 percent of all activities and 67 percent of all materials appealed to this learning style.

The least accommodated learning styles were the olfactory (0 occurrences) and the kinesthetic (8 occurrences). All appeals to the kinesthetic style occurred within Institute activities rather than materials, and all resulted from group work or participant (learner) presentation of projects.

Facilitation of Thinking Skills/Processes

All eight of the micro-thinking skills (Level III skills) and all three of the Level I thinking strategies identified by Beyer were incorporated into Institute activities and materials. Since no analyses for Beyer's Level II critical thinking skills were conducted, no data regarding their presence are available.

The first three levels of the micro-skills hierarchy (recall, translation, interpretation) were those most required of learners. Institute participants were required to translate basic information 58 times, recall information 54 times and interpret information 53 times. It is interesting to note that Bloom[7] incorporated both translation and interpretation into level two (comprehension) of his cognitive hierarchy, the framework upon which Beyer has based his micro-thinking skills structure. Extrapolation behavior which was elicited at least 35 times during the Institute is also a part of Bloom's level two. In essence, 64 percent of the micro-think behaviors elicited in the Institute (200 of 314 total behaviors) represented levels one and two of Bloom's hierarchy. This preponderance of facilitation of lower level thinking is not unexpected, if one is familiar with other studies of instructional settings. The fact that 36 percent of all micro-thinking behaviors elicited were at level three or above in the Bloom framework is notable because this percentage indicates a pattern of higher order thinking which exceeds that found in a number of other studies.

Also important is the finding that Institute activities (not materials) elicited complex thinking processes 36 times. Participants were required in the course of their activities to conceptualize fifteen times, make decisions eleven times and solve problems ten times.

CONCLUSIONS

Several conclusions result from the findings of this simple study:

1. The creation and interpretation of thematic maps are instructional activities which contribute naturally and substantially to accommodation of a range of perceptual learning styles.

Geographers have promoted thematic map making and utilization across the curriculum as a vehicle to present and address a variety of issues and problems. Concomitently, teachers who use activities and materials modeled in this Institute will be reaching a broad spectrum of learners whose perceptual styles

may not allow them to obtain knowledge presented in more traditional ways.

2. The creation and interpretation of thematic maps are instructional activities which contribute naturally and substantially to the development of higher order thinking skills and processes among learners.

A great deal of concern exists about the failure of current educational processes to develop thinking skills in learners. Findings of this study indicate that activities, materials and interactions used in generating and interpreting thematic maps produce a great deal of critical and creative thinking. Since thematic mapping lends itself to instruction in a number of content areas, it provides a vehicle for teaching thinking within the curriculum rather than apart from it.

3. Simple analyses of instructional activities and materials can generate valuable information for instructional decision making.

Areas of educational and instructional concern are often translated into new programs to be added to the curriculum or new strategies to be incorporated into instruction. This approach to educational improvement frustrates teachers who feel that they cannot add another new program to an already full schedule, or that they cannot easily change their current modes of instruction. In this study, investigators conducted simple analyses of activities and materials already planned and implemented. The analyses confirmed that a range of learning styles and thinking skills were already being addressed. Those findings provided positive reinforcement to instructors as well as confirmation of the value of the Institute to its sponsors. In addition, the findings provide instructors information which they can use to modify instruction the next time this particular institute is offered. Similar, simple analyses of instructional activities and materials in classrooms at all levels can be as useful. Perhaps more is being done to teach and facilitate thinking than is known. Perhaps multiple learning styles are regularly being accommodated by teachers. If not,

minor modifications might address the problems. Often, large sums of money are allocated and large amounts of time given to curricular and instructional reform without first collecting data upon which to base decisions. The results of this study support a different approach.

NOTES AND REFERENCES

[1]Learning style is an "umbrella" concept encompassing several modes of learning. There is evidence which suggests that one's learning style includes cognitive, emotional and social modes as well as the perceptual mode targeted here.

[2]French, Russell L. "Instructional Strategies and Learning Processes," Educational Considerations, Vol. III, No. 1 (Fall, 1975), pp. 27-28.

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[6]Beyer, Barry. Developing A Thinking Skills Program. Boston, Allyn and Bacon, Inc., 1988.

[7]Bloom, Benjamin, et. al. Taxonomy of Educational Objectives. Handbook 1: Cognitive Domain. New York: Longman, 1956.

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APPENDIX

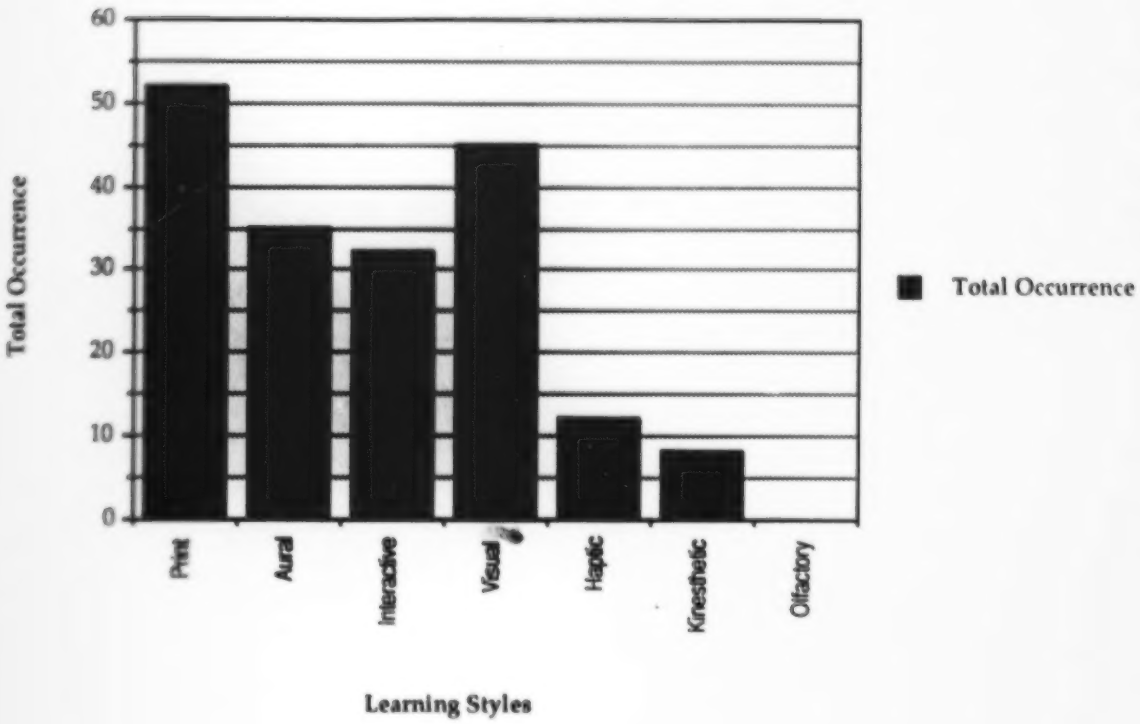

Figure 1: Opportunities For Participant Use of Perceptual Learning Styles In The Institute On Thematic Map Utilization.

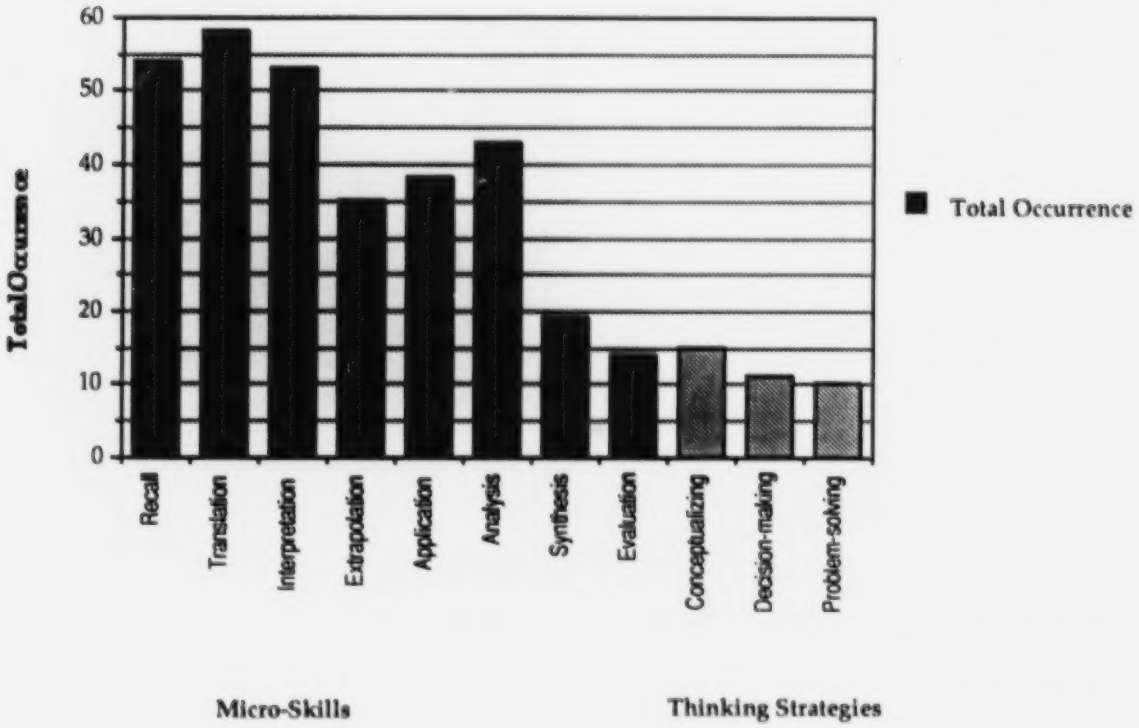

Figure 2: Opportunities For Participant Use of Thinking Skills And Processes In The Institute On Thematic Map Utilization.

Analyses of Lear

Week	Day	Activity	Recall: Low
1	1	Introduction to Thematic Maps (1,2)	X
1	1	Assignment (1)	X
1	1	Basic Map Reading (1,2)	X
1	2	Data for Thematic Mapping (1,2)	
1	2	Transforming Data: Group Activity (3)	X
1	2	Project Assignment (1)	X
1	2	Discussion of Previous Sessions (2)	X
1	2	Percentages in Mapping (1,2)	X
1	2	Map Comparison (1,2)	
1	2	Map Design (1,2)	X
1	3	Assignments (1,2)	X
1	3	Cartograms (1,2)	X
1	3	Cartogram Activity (3)	X
1	3	Discussion of Assignments (2)	
1	3	Types of Thematic Maps (1,2,4)	
1	3	Project Work (3)	X
1	4	Panel Discussion (2)	
1	4	Student Presentation of Projects (1,2,4)	
1	4	Finding Second Level Attributes (1,2)	

1 = Presentation, 2 = discussion, 3 = group activity, 4

rning Styles/Thinking Skills

Translation	Interpretation	Extrapolation	Application	Analysis	Synthesis	Evaluation	Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Level I Conceptualizing	Level II Decision-Making	Level III Problem-Solving
Thinking Skills ← *Micro-Skills* → High							Learning Styles							Thinking Strategies		
X	X	X	X	X				X	X	X						
X								X	X							
X	X	X	X				X	X	X	X						
X	X	X	X	X	X	X	X	X	X	X						
X	X	X	X	X	X		X	X	X	X	X			X		
X								X	X							
X	X	X	X	X	X			X	X					X		
X	X	X	X				X	X	X		X					
				X	X	X		X	X	X						
X	X						X	X	X	X						
X							X	X								
X	X	X					X	X								
X	X	X	X	X	X		X			X	X			X	X	
		X	X	X				X	X							
X	X	X	X	X	X	X	X	X	X	X				X	X	
X	X	X	X	X	X		X	X	X	X	X	X		X	X	X
			X	X	X			X	X							
			X	X	X	X	X	X	X	X		X		X	X	X
X	X	X	X	X	X	X	X	X	X	X				X		X

= demonstration

Analyses of Lear

Week	Day	Activity	Recall: Low
1	4	Discussion of Assignment (1, 2)	X
1	4	Group Work on Project (3)	X
1	5	Student Presentation of projects (1,2,4)	
1	5	How to Improve the Manual (2)	
1	5	Walking Tour of Map Library (3)	X
1	5	Thinking Skills and Learning Styles (1)	X
2	1	Group Work on Projects (3)	X
2	1	Thematic vs. Reference Maps (1,2)	
2	1	Using the MacIntosh Computer (1,2,4)	X
2	2	How to Develop Good Map Presentations (1,2,4)	X
2	2	Thematic Maps Across the Curriculum (1,2)	
2	2	Group Work on Projects (3)	X
2	2	Computer Map Making (1,2,4)	X
2	3	Project Presentations (1,2,4)	X
2	3	Assistance in Computer Map Making (3)	X
2	4	Project Presentations (1, 2, 4)	X
2	5	Sharing Session (2), Evaluation	X

rning Styles/Thinking Skills

Translation	Interpretation	Extrapolation	Application	Analysis	Synthesis	Evaluation	Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Level I Conceptualizing	Level II Decision-Making	Level III Problem-Solving
Thinking Skills ← *Micro-Skills* → High							Learning Styles							Thinking Strategies		
X								X	X							
X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
			X	X	X	X	X	X	X	X		X		X	X	X
X	X	X	X	X	X	X		X	X							
			X					X	X	X		X				
X	X		X				X	X		X						
X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
			X	X			X	X	X	X						
X	X		X					X	X	X	X					
X							X	X	X	X						
X	X	X	X					X	X	X				X		
X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
X	X	X	X					X	X	X	X					
X	X	X	X	X	X	X	X	X	X	X				X	X	X
X	X		X					X	X		X					X
X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
X	X		X			X	X	X	X	X				X	X	

Analyses of Lea

Week	Day	MATERIALS Activity	Recall Lo
1		Thematic Map Topic	X
1		Population Density Maps	X
1		Food Production Maps	X
1		Land Area and Commercial Forest Table	X
1		Sample Cartograms	X
1		Results of 1861 Election (Table)	X
1		Summary of Selected Map Projections (Table)	X
1		State population Map	X
1		Population Map of South America	X
1		GNP Map of South America	X
1		Absolute Numbers/Percentages Slaveowners (Tbl	)X
1		Blank World Map	
1		Map of Tennessee Counties	X
1		Aid to Dependent Families (Table)	X
1		Per Capita GNP Map, 1985	X
1		Map: Medium Income of Families	X
1		Percentage of Population Completing H.S. (Tbl	)X
1		Map: Divorce Rate, 1981	X

rning Styles/Thinking Skills

Translation	Interpretation	Extrapolation	Application	Analysis	Synthesis	Evaluation	Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Level I Conceptualizing	Level II Decision-Making	Level III Problem-Solving
Thinking Skills *Micro-Skills* (← w … High)							Learning Styles							Thinking Strategies		
X	X	X		X	X	X	X									
X	X		X	X			X			X						
X	X		X	X			X			X						
X	X						X									
X	X	X	X	X			X			X						
X	X			X			X									
X	X			X			X									
X	X	X		X			X			X						
X	X	X		X			X			X						
X	X						X			X						
X	X						X									
							X				X					
X	X									X						
X	X	X		X			X									
X	X	X		X			X			X						
X	X	X		X			X			X						
X	X	X		X			X			X						
X	X	X	X	X			X			X						

Analyses of Lear

Week	Day	MATERIALS Activity	Recall Low
1		Map: Deaths From Suicide, 1981	X
1		Map: Deaths From heart Disease, 1981	X
1		Map: Death Rates, 1981	X
1		Geography and Educational Reform	X
1		Sample Computerized Maps	X
1		Table: Number of Tornadoes	X
1		Sample Thematic Map: Music	X
1		Table: Comparison of Maps	X
1		Tennessee Map and Table	X
1		Map: Hispanic Population in Midwest	X
1		Map: Wheat Production, 1985	X
2		Map Used in Student Presentation	X
		TOTAL OCCURRENCES	54

rning Styles/Thinking Skills

Translation	Interpretation	Extrapolation	Application	Analysis	Synthesis	Evaluation	Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Level I Conceptualizing	Level II Decision-Making	Level III Problem-Solving
Thinking Skills ← *Micro-Skills* → High							Learning Styles							Thinking Strategies		
X	X	X	X	X			X			X						
X	X	X	X	X			X			X						
X	X	X	X	X			X			X						
X	X						X									
X	X		X				X			X						
X	X			X			X									
X	X	X	X	X			X			X						
X	X			X			X									
X	X	X		X	X		X			X						
X	X	X		X			X			X						
X	X	X		X			X			X						
X	X		X	X			X			X						
58	53	35	38	43	19	14	52	35	32	45	12	8	0	15	11	